OCEAN SURFACE REMOTE SENSING WITH AIRCRAFT MICROWAVE SCATTEROMETER AND RADIOMETER

Simon H. Yueh, Son V. Nghiem, William J. Wilson, Steven J. Dinardo
Gregory Neumann, Richard West, and Fuk K. Li
Jet Propulsion Laboratory
California Institute of Technology
4800" Oak Grove Drive
Pasadena, CA 91109
Tel: (818) 354-3012, Fax: (818) 393-5285, Email: Simon@malibu.jpl.nasa.gov

Ocean winds are a key driving force of momentum, humidity, and heat exchanges between the atmosphere and ocean. Measurements of ocean wind are critical for meterological and air-sea interaction studies. Many satellite scatterometers, including Sea Sat scatterometer, ERS-1 and -2 scatterometers, and NASA scatterometers (NSCAT/SeaWinds) have been or will be flown to map ocean surface winds based on the dependence of microwave radar backscatter on ocean wind speed and direction. Data from satellite scatterometers and many aircraft and tower-based measurements, however, have suggested that the microwave scatterometer signatures of ocean surfaces are influenced by many other oceanic parameters. The dependence of microwave backscatter on air and sea surface temperatures and significant wave height will be discussed with the aid of data acquired by the Jet Propulsion Laboratory's (JPL) aircraft NUSCAT Ku-band scatterometer and ERS-1 C-band scatterometer. In addition to scatterometer observations, it has been discovered recently that passive microwave radiometer signatures of sea surfaces are also sensitive to wind direction as well as wind speed. JPL has conducted a series of aircraft polarimetric radiometer flights over the National Data Buoy Center (NDBC) buoys deployed off the US west coast from 1993 to 1996 to determine the correlation of polarimetric brightness temperatures of sea surfaces with ocean wind speed and direction at 19 and 37 GHz from 45° to 65° incidence angles. Measured radiometric temperatures from all polarization channels showed the directional dependence at 2 to 24 m/s. Wind directional signals observed in the 37 GHz channel were similar to those in the 19 GHz channel. This indicates that the sea surfaces have a similar directional spectrum at centimeter and millimeter wavelengths. Harmonic coefficients of the wind direction signals were derived from experimental data versus incidence angles. With surface measurements by buoys, effects of air and sea surface temperatures and significant wave height on the harmonic coefficients are studied. To further quantify the signatures of sea surfaces in scatterometer and radiometer measurements, a set of flights has been planned to acquire simultaneous active and passive microwave observations with the JPL NUSCAT and polarimetric radiometers in the Atlantic Ocean off the US east coast in October 1996. The active and passive signatures will be compared to assess the feasibility of inverting multiple oceanic parameters with collocated scatterometer and radiometer data.

Suggested sessions for presentation: Oceanographic Applications
Preferred presentation method: Plenary or poster